3.3 Using the Mean

At a Glance

PACING 1 day

Mathematical Goal

- Experiment with how the mean, as a measure of center, responds to changes in the number and magnitude of data values

Launch

Materials
- Transparencies 3.3A, 3.3B

The data used in this problem were collected from a group of middle school students who answered this question: How many movies did you watch last month? Consider asking:

- *How would you answer this question: How many movies did you watch last month? What do we mean by a movie?*

There are some misunderstandings about what "movie" means in this context. Discuss possible ways students might interpret what is being asked. Your students might want to think about the mean number of movies watched per day. Have pairs work together to complete the problem.

Explore

Materials
- Large sheets of unlined paper

Check to see that for each part of Problem 3.3 students continuously add the new values of movies watched. For Question B, when adding 31 to the stem plot, check to see that students are adding the stem of 3. Remind students to explain what they observe is happening to the mean in Questions B and C. For students struggling with Question D, ask them to reason part (1) by using what happened to the mean in Question B as an example when they added 31 movies. Ask them to reason part (2) by what happened to the mean in Question C when those values were added to the data.

Summarize

Materials
- Student notebooks

Begin the discussion by asking students the following questions:

- *What was the mean number of movies in Question A?*
- *In Question B, a student whose data value is much greater than the rest of the data is added. What happened to the mean?*
- *In general, what effect do you think outliers have on the mean of a data set? Why?*
- *In Question C, several students' data were added. They clustered near the lower end of the distribution, but were not outliers. Because there are several lower values, they still affect the mean. Let's test our ideas on our data.*
- *What data values could you add to cause the mean of the 9 movies to increase?*
- *What data values could you add to cause the mean of 9 movies to decrease?*
- *What data values could you add to cause the mean of 9 movies to remain the same?*

ACE Assignment Guide for Problem 3.3

Differentiated Instruction — Solutions for All Learners

Core 11, 17, 23
Other *Connections* 9, 12–16, 18; *Extensions* 22; unassigned choices from previous problems

Adapted For suggestions about adapting ACE exercises, see the CMP *Special Needs Handbook.*
Connecting to Prior Units 12–16: *Bits and Pieces I*

Answers to Problem 3.3

A. **1.** The total number of students is 10.

2. The total number of movies watched is 90.

3. The mean number of movies watched is 9.

B. **1.** When 31 is added to the stem plot, there is a gap between 18 and 31 movies watched.

Movies Watched

0	3 3 5 6 6 7
1	1 5 6 8
2	
3	1

Key: 1 | 5 means 15 movies

2. Yes, because it is much greater than the other values in the data set.

3. The new mean is 11 movies.

4. The mean for Question A is 9, and the new mean for Question B is 11. The mean for Question B is greater than the mean for the data in Question A. Because 31 is a much greater number of movies watched than the values that were in Question A, it increases the mean.

C. **1.** The eight new values increase the number of values in the 0–9 interval.

Movies Watched

0	2 2 3 3 4 4 4 5 5 5 5 6 6 7
1	1 5 6 8
2	
3	1

Key: 1 | 5 means 15 movies

2. The new data values are not outliers because they fall where the data were already clustered in the 0–9 interval.

3. The new mean is about 8 movies.

4. The new mean is less than the mean in Questions A (9) and Question B (11). The mean has decreased from the mean of 11 movies in Question B because the 8 new values cluster at the low end of the data set.

D. **1.** Adding outliers to the data set can greatly affect the mean. Adding much greater numbers "pulls" the mean up (increases it), and adding much smaller numbers pulls the mean down (decreases it).

2. Adding data values that cluster near one end of the data affects the mean by "pulling" it in the direction of the data added.

3. These changes occur because increases (or decreases) in data values, when added to the sum of all the data values and divided by the number of data values result in a quotient (mean) that is greater (less) than the mean before the new data values were included.